CLAIMS

WHAT IS CLAIMED:

1. A method, comprising:

forming a nitrogen-enriched silicon carbide-containing layer over a substrate; and

modifying at least an exposed surface of said nitrogen-enriched silicon carbide-containing layer by treating the exposed surface with an inert plasma atmosphere.

2. The method of claim 1, wherein said plasma atmosphere is established without interrupting a vacuum condition generated during the formation of said nitrogen-enriched silicon carbide-containing layer.

3. The method of claim 1, wherein said plasma atmosphere is substantially established from helium.

4. The method of claim 1, wherein said nitrogen-enriched silicon carbide-containing layer is formed by plasma enhanced vapor deposition.

5. The method of claim 1, further comprising, prior to modifying the surface, purging said substrate with a gas used to establish said plasma atmosphere.

6. The method of claim 5, further comprising, prior to modifying the surface, establishing a stabilized gaseous atmosphere including a gas used to subsequently establish said plasma atmosphere.

7. The method of claim 1, further comprising forming a low-k dielectric layer over said nitrogen-enriched silicon carbide-containing layer, wherein diffusion of contaminants emanating from said nitrogen-enriched silicon carbide-containing layer is reduced due to the surface modification.

8. The method of claim 7, further comprising patterning said low-k dielectric layer by photolithography and etching, wherein resist poisoning is reduced by said reduced diffusion of contaminants.

9. The method of claim 8, wherein patterning said low-k dielectric layer includes forming a via in said low-k dielectric layer by means of a first resist mask and forming a trench in an upper portion of said low-k dielectric layer by means of a second resist mask.

10. The method of claim 9, further comprising, prior to forming said trench, performing an out-gassing step to remove contaminants.

11. The method of claim 8, further comprising determining a degree of said resist poisoning.

12. The method of claim 11, further comprising controlling, on the basis of said determined degree, at least one process parameter for treating the surface with said plasma atmosphere.

13. A method of forming a metallization layer, the method comprising:

depositing a nitrogen-containing low-k barrier layer over a substrate;

modifying a surface of said nitrogen-containing low-k barrier layer by introducing noble gas atoms into a region of said barrier layer by exposing said barrier layer to a plasma treatment comprising a noble gas;

depositing a low-k dielectric layer over said low-k barrier layer;

patterning said low-k dielectric layer by a lithography process, wherein said modified surface reduces resist poisoning in said lithography process; and

forming a metal region in said patterned low-k dielectric layer.

14. The method of claim 13, wherein said nitrogen-containing low-k barrier layer comprises silicon carbide.

15. The method of claim 13, wherein depositing said nitrogen-containing low-k barrier layer and modifying a surface thereof is performed without exposing said substrate to an ambient atmosphere.

16. The method of claim 13, wherein said plasma treatment includes establishing a plasma atmosphere on the basis of a noble gas.

17. The method of claim 16, further comprising stabilizing a gas atmosphere including helium prior to establishing said plasma atmosphere.

18. The method of claim 16, further comprising purging said substrate with a noble gas prior to establishing said plasma atmosphere.

19. The method of claim 13, wherein patterning said low-k dielectric layer includes forming a via in said low-k dielectric layer by means of a first resist mask and forming a trench in an upper portion of said low-k dielectric layer by means of a second resist mask.

20. The method of claim 19, further comprising, prior to forming said trench, performing an out-gassing step to remove contaminants.

21. The method of claim 19, further comprising determining a degree of said resist poisoning.

22. The method of claim 21, further comprising controlling, on the basis of said determined degree, at least one process parameter for said plasma treatment.

23. A semiconductor device, comprising:

a substrate;

a metallization layer formed above the substrate, the metallization layer including:

a dielectric barrier layer comprising silicon carbide and nitrogen, the dielectric barrier layer having a first surface and a second surface, wherein a noble gas atom concentration at said first surface is higher than at said second surface, and

a low-k dielectric layer having formed therein a metal region, wherein said first surface is in contact with said low-k dielectric layer.

24. A method, comprising:

forming a barrier layer comprised of a nitrogen-enriched silicon carbide-containing layer over a substrate;

exposing a first surface of said barrier layer to a plasma ambient comprising a noble gas to thereby increase a concentration of atoms of said noble gas in a first region of said barrier layer having a first depth;

forming at least one dielectric layer above said barrier layer after said first surface of said barrier layer is exposed to said plasma ambient; and

forming a conductive interconnection in said at least one dielectric layer.

25. The method of claim 24, wherein said nitrogen-enriched silicon carbide containing layer is comprised of approximately 10-30 weight percent nitrogen.

26. The method of claim 24, wherein said noble gas is comprised of at least one of helium, argon and krypton.

27. The method of claim 24, wherein said first depth ranges from approximately 0.3-3 nm.